

REMARKS

Applicants are filing herewith an RCE in response to the final rejection mailed May 17, 2005. Applicants respectfully traverse the rejection of the claims and respectfully request reconsideration.

Claims 1-4, 12 and 13 were rejected over Scott '070 in view of Griffin '985. Scott discloses a free standing layer of a diamond film, not a coating. The diamond film is formed on a carbide substrate, such as by chemical vapor deposition technique, then removed from the carbide and secured to the bearing shaft or mating cone by means of brazing or soldering. A free-standing layer attached to a bearing element by brazing is not a coating. A coating is a deposit that is formed on the bearing element, not an attached layer. So as to be clear, applicants have amended all the independent claims to require that the diamond-like coating be deposited on the bearing surface.

Griffin discloses the use of diamond or diamond-like material, but the material is part of the body of a polycrystalline diamond (PCD) cutting element or insert. The element shown in Figure 1A is attached to the exterior of a drag bit (Fig. 2), and the element shown in Figure 5 is press-fitted into mating holes in a rolling cone bit (Fig. 3). These elements are used under completely different conditions than a bearing surface within a sealed lubricant chamber.

Claims 1, 9 and 14-15 were rejected over McCallum '274 in view of Nishiyama '644. McCallum discloses a thrust washer made of a steel alloy and does not suggest any type of coating. Nishiyama teaches a diamond coating on both sides of a thrust washer, but teaches to use a thrust washer made of carbide material, not a steel alloy. Nishiyama teaches away from a hard-metal alloy, which would include steel alloys, at column 1, lines 25-27. Nishiyama states that hard particles contained in the drilling fluid find their way into the bearing mechanism causing a beryllium-copper alloy or other hard metal alloy to sustain wear. Nishiyama thus teaches to deposit a diamond film on a tungsten carbide ring. Combining McCallum with Nishiyama would teach one skilled in the art to replace the steel alloy thrust washer of McCallum with a tungsten carbide washer having a diamond or diamond-like coating. One cannot simply take the coating of Nishiyama and apply it to a steel washer. Rather, one has to accept the entire teachings of Nishiyama, which is to apply the diamond coating to carbide. There would be no motivation to use a steel washer because one would not know whether or not

the diamond would properly be supported by such a steel alloy. A diamond or diamond-like coating is very hard and rigid, thus needs a strong supporting base.

Nishiyama teaches that the support (column 4, lines 64-66) should be from a composite material in which the main ingredient is tungsten carbide. In column 8, lines 9 and 10, Nishiyama uses a conventional bearing of a beryllium-copper alloy for a reference against tests made of bearings having a tungsten carbide base and a diamond coating. Nishiyama does not suggest at all that the diamond or diamond-like coating could be applied to any supporting member other than a tungsten carbide member. A ring of beryllium copper alloy would be less expensive than a ring of tungsten carbide, and if such a ring were suitable for receiving a coating of diamond or diamond-like coating, one would think Nishiyama would suggest it.

Claims 1, 10 and 21-22 were rejected over Murdoch '922 in view of Nishiyama. Murdoch teaches a steel alloy, but not a steel alloy having a diamond coating. Murdoch teaches to coat a steel alloy bearing surface with a material having anti-galling and lubricating properties, column 1, lines 51-53. Murdoch discloses that the bearing may be of a beryllium-copper alloy. The coating is of a soft lubricant metal, such as lead, indium, tin, copper or silver (column 2, lines 6-9). A diamond or DLC coating is a very hard material, not a lubricating material. Combining the DLC or diamond material of Nishiyama with the beryllium-copper alloy of Murdoch would teach away from Murdoch's desired result, which is lubricating. Furthermore, as mentioned above, one cannot simply take the coating teachings from Nishiyama, but must consider the substrate on which Nishiyama deposits the coating, which is a carbide ring. The combination of Murdoch and Nishiyama results in a carbide ring with a diamond coating in the drill bit of Murdoch.

Further, Nishiyama despositos the coating to have increased wear resistance, not provide lubrication. The bit of Murdoch does not show a lubricant cavity for supplying lubricant to the bearings, thus it appears to be important to supply lubrication from the coating of soft material. Nishiyama, on the other hand, shows passages 10 and 11 for a supply of grease (column 4, lines 54-57).

Claim 16 was rejected over McCallum '274 in view of Nishiyama. Intermediate element 54 of McCallum is constructed of material having anti-galling properties or the element has a coating over the entire surface of intermediate element 54. The anti-galling materials my be copper-based alloys, silver babbitt metal, aluminum and zinc (column 5, lines 4-6). Intermediate

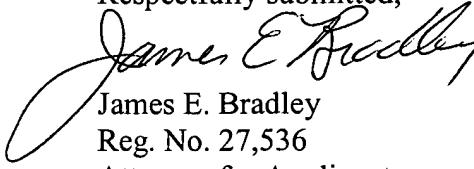
element 94, shown in Figure 5, may have hard wear resistant materials covering the entire surface interspersed with other materials. These hard wear resistant materials comprise hardened steel, hardened aluminum bronze and tungsten carbide (column 5, lines 1-3). When combining the teachings of Nishiyama with McCallum, one would substitute a tungsten carbide ring having a diamond or diamond-like coating for the intermediate elements 54 and 94. There is no motivation or suggestion that the diamond or diamond-like coating would be suitable on a stainless steel thrust washer.

Claim 17 was rejected over McCallum in view of Nishiyama and further in view of Garner and Griffin. Garner, like Nishiyama, teaches to place diamond on a carbide substrate. In Figure 2, diamond 37 is located on carbide 38. All of the embodiments disclose diamond on carbide substrates.

Griffin, previously discussed, deals with cutting teeth, not a bearing surface. The same arguments as above are applicable in regard to the rejection of claims 18, 19 and claim 20. Lemelson deals with diamond-like materials placed on a glass rim. This reference has nothing to do with steel bearing elements.

Applicants reiterate that not a single reference shows a diamond-like carbon coating deposited on a steel member and certainly not such a coating deposited on a thrust washer or bearing sleeve of an earth-boring drill bit. Applicants respectfully submit that the claims are now in condition for allowance and favorable action is respectfully requested.

Respectfully submitted,



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